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ABSTRACT

A study determining the relationship between selected program characteristics, student enrollment patterns, and scores attained on the national certification examination in the field of cytotechnology is presented. Information is included on the type of program, teaching and testing methods employed, the difference between students entering the cytotechnology training area with an associate degree and a bachelors degree, and how these factors affect the outcome of the student registry scores. Research questions included: the relationship between student program level and registry scores attained; the overview of the program characteristics of the cytotechnology programs nationwide; and the perceived employment outlook for the graduating cytotechnology student. Study subjects were the education coordinators of the 47 cytotechnology programs (only 39 of which are presently active) in the United States who completed a questionnaire with items of both closed and open form. Items addressed student enrollment patterns, demography, placement rate of students in the work force, and student performance on the August 1987 certification examination. Some of the results are as follows: bachelors degree students performed no better on the national certification examination than did the associate degree students; the schools have a variety in the number of individuals involved in student instruction; schools reported receiving requests for cytotechnologists an average of 2,700 miles from their program; and there is a critical shortage of trained, certified cytotechnologists. A copy of the education survey is appended. Contains 11 references. (SM)

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An Investigation into Selected Program Characteristics, Student Enrollment Patterns and Attained Certification Examination Scores in the Field of Cytotechnology

Presented by

Carol A. Gervais Paquette

to

The Graduate Program in Occupational Education in Partial Fulfillment of the Requirements for the Degree of

Masters of Science in the field of Occupational Education

Ferris State University
Big Rapids, Michigan
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Introduction

Originally cytotechnologists were instructed in the skill (art) of cellular diagnosis sitting at a microscope under the tutelage of a pathologist. Both normal cellular morphology and the degrees of abnormality that can be seen in the diseased cell were taught. As the need for cytotechnologists grew, cytotechnology training programs were established. Soon to follow were the institution of specific educational prerequisites for admission to these programs and the establishment of a National Certifying Examination (Registry).

Background of the Problem

Formerly, cytologic specimens consisted primarily of female gynecological (GYN) smears. Due to the advancements in specimen collection techniques such as fine needle aspiration, cells from any body site can be examined by the cytotechnologist to diagnose their state of health or disease. This has significantly increased the number of specimens seen by the cytology laboratory. Hence, there continues to be a need for these specially trained individuals. Unfortunately, the demand for properly trained and certified cytotechnologists far exceeds the supply in today's job market. The American Society of Cytology (ASC) reports that in the academic year 1987-88 only 131 senior students are enrolled to fill the 220 job openings currently available nationally (ASC, Subcommittee for Student Recruitment, 1988).

In the past, the educational requirements for entering

a cytotechnology program varied somewhat. As a result, there are currently, practicing cytotechnologists with a variety of educational backgrounds including: on the job trained (OJT), associate degree and bachelors degree trained individuals. Today, the perspective student must fulfill the requirements for admission to the cytotechnology programs established in July 1985. They are as follows:

> Beginning July 1985, the applicant should have acquired an academic background at the college level, including basic chemistry and biology courses at the introductory level, emphasing body structure, development and function, before being accepted by an accredited cytotechnology program. This preparatory work should include a minimum of 20 semester hours or 30 quarter hours in the biological sciences. The courses in biology may include: general biology, bacteriology, parasitology, physiology, anatomy, histology, embryology, zoology and genetics. Eight semester hours (12 quarter hours) in chemistry are also required (ASC, Brochure "A Career in Cytotechnology").

After fulfilling these requirements, the applicant can be accepted into the cytotechnology training program and embarks on specialized training of at least a year's duration.

> The length of baccalaureate programs varies from one year (12 months) to two years (24 months).

> Upon successful completion of an approved program in cytotechnology, the student is eligible to take a registry examination given by the American Society of Clinical Pathologists (ASC, Brochure "A Career in Cytotechnology").

During enrollment in the cytotechnology program the student is involved in a "curriculum consisting of didactic instruction" including lectures, textbooks, quizzes and tests, "and supervised clinical laboratory experience." where the student learns how to handle, stain and screen specimens and practice the skill (art) of diagnosing patient specimens. "A certificate is awarded upon the successful completion of the training" (ASC, Brochure "A Career in Cytotechnology").

While pursuing a course of study in cytotechnology, the student is first taught the cellular configuration and criteria for the normal cellular samples that are examined. These samples may be from the female genital tract, the respiratory tract, body fluids including urine, and any other body site from which cellular samples may be obtained for analysis and diagnosis. The student progresses to learning how to evaluate abnormality in cellular samples. These abnormalities encompass a continuum of cellular changes which may occur; from an inflammatory non-malignant situation to the various pre-cancerous changes that occur and finally the full blown malignant changes apparent in the cancerous cell. The type of program, the methods of

instruction and the instructors provide the necessary ingredients whereby students learn this area of allied health and can become an active participant in the diagnostic branch of total health care.

At the culmination of the training program, the graduate cytotechnologist is put to the ultimate test when taking the national certification examination in order to attain certification in cytotechnology. Upon successful completion of the national certification examination, "a cytotechnologist may place the initials CT(ASCP) after her/his name" (ASC, Cytotechnology Program Review Committee, Letter, 1988). The benefits that result from passing the national certification examination include, an increase in salary and a chance for upward mobility (e.g. supervisor, educator) as a registered cytotechnologist in the cytology laboratory.

As of August 1988, the Board of Registry requires completion of a baccalaureate degree before one is eligible to take the certification examination. In light of the apparent shortage of trained registered cytotechnologists this change to mandatory BA/BS degree and the closing of many approved cytotechnology programs may be detrimental to the future of the profession (ASC, Cytotechnologist's Bulletin, 1988).

Purpose Statement

The purpose of this study was to determine the relationship between selected program characteristics,

student enrollment patterns and scores attained on the national certification examination in the field of cytotechnology. This research was undertaken to provide information concerning the type of program, the teaching and testing methods employed, the difference between students entering the cytotechnology training area with an associate degree and a bachelors degree and how these factors affect the outcome of the student registry scores.

Research Questions To Be Answered

1. What was the relationship between student program level and registry scores attained?
2. What was the relationship between instructional methods used and attained registry scores?
3. What was the overview of the program characteristics of the cytotechnology programs in the nation?
4. What was the national pattern of student enrollment in cytotechnology?
5. What was the perceived employment outlook for the graduating cytotechnology students?

Assumptions

The following assumptions were made with respect to this study:

1. The data provided by the schools of cytotechnology is accurate.
2. The surveys reached individuals qualified to answer the questions.

3. The questions were interpreted and answered by the respondents as expected by the researcher.
4. Certification examination scores reflect proficiency in cytotechnology.

Limitations

This study was conducted in view of the following limitations:

1. The data were only representative of the schools that responded.
2. Questions left unanswered affected the data outcome for those specific topics.

Chapter II

Literature Review

Baccalaureate Degree versus Non-Baccalaureate Degree

From the time that the certification examination was instituted for the cytotechnologist and the educational prerequisites were established for admission into accredited cytotechnology training programs, there has been a controversy as to whether or not the associate degree provided enough educational background for the prospective cytology student. Some felt that a bachelors degree was necessary. In 1984 the American Society of Clinical Pathologists (ASCP) made the announcement that as of August 1988 a baccalaureate degree, including a specified number of credits in biology, chemistry and math, would be required for eligibility to take the National Certification Examination (ASC,Cytotechnology Program Review, Letter, 1988).

> After careful consideration of the concepts of the technologist level of certification and task performance surveys from the field, the minimum educational requirements for the cytotechnology examination, CT(ASCP) were set at the baccalaureate degree with requirements in biological sciences, chemistry and mathematics (Board of Registry, Newsletter, 1985).

Thus, the arguement was settled by the certifying agency. However, no published studies were available to this researcher to indicate that obtaining a bachelors degree does, in fact, better prepare cytotechnologists for their chosen field.

In the ACTA Cytological article by Dr. Rhonda Karp "Perceptions of the Impact of Baccalaureate Degrees for Cytotechnologists", the importance of the baccalaureate degree for the cytotechnologist is examined from the point of view of the medical directors, the education coordinators and the cytotechnologists. The following conclusions were reported as a result of a random sampling questionnaire mailed to the above mentioned groups.

1. Education coordinators and cytotechnologists generally perceive a greater impact of degrees than do medical directors.
2. Education coordinators perceive more impact on career mobility from degrees than do medical directors.
3. Medical directors perceive less impact from degrees on professional status than do the other two groups.
4. There was little difference in the perceptions of the impact of degrees on salaries and changes in cytotechnology education.
5. Degrees are perceived to have more impact on career mobility than on salaries, professional

status or changes in cytechnology education (Karp, 1979).

Dr. Karp's paper provided data on the issue of the perceived importance of the bachelors degree for the cytotechnologist. The findings expressed in the paper indicated that there was a difference in perception of the significance and impact of the baccalaureate degree between the medical director, education coordinator and the cytotechnologist. The area of most impact appeared to be the opportunities that the bachelors degree provides for career mobility: teaching, supervising, management or movement into a related area . It was also pointed out that cytotechnology educators must be aware of the career mobility interest of their students and provide opportunities for broader background in their baccalaureate curriculum. However, this paper stated, "Research concerning the impact of baccalaureate degrees for cytotechnologists is practically nonexistent" (Karp, 1979). The investigator suggested that the following related problems and questions needed further investigation:

*Will the existence of two levels, i.e., degreed and non-degreed, of entry-level cytotechnologists encourage a stratification of employment levels in the field?

*How do employers, including the armed forces and civil service, perceive baccalaureate degrees for cytotechnologists? Will they pay more or give

preference to degreed cytotechnologists?

*Should the expanded curriculum of degree programs be monitored or regulated in any way or left to the discretion of the educators in each program?

*What is the cost-benefit ratio for cytotechnologists in earning a baccalaureate degree?

*If higher salaries are paid to cytechnologists holding a degree, will they affect the cost of patient care? (Karp, 1979).

In 1977, Catherine Keebler in the Acta Cytologica article "The Future Role of the Cytotechnologist", discussed not only the present roles that the trained registered cytotechnologist must fill but the future education, training and degree requirements of the prospective students in cytotechnology. She wrote:

> In the future the cytotechnologist will without exception graduate from a degree program in an allied health program where the hospital laboratory will serve only to supply the practical experience and will be less utilized than now for the didactic or basic teaching responsibilty for administration of these programs will be the full-time cytotechnologist educational coordinator.
>
> After graduating from these degree programs, cytotechnologists will work in larger clinical laboratory centers where increased quality and

> more quantity will be required to reduce the cost of cytology services to the patient. Regulatory agencies will monitor working conditions, certification, continuing education and may administer proficiency tests to the cytotechnologist and cytopathologist at regular intervals. On-the-job (OJT) training for the cytotechnologist will be a thing of the past (Keebler,1977).

Increased educational background and increased program electives in cytotechnology program curricula should better prepare the student for the changes and demands in the field.

The above studies explored the added opportunities that might be available to bachelors degree level cytotechnologists. However, neither of the above studies evaluated the difference in bachelors degree, associate degree and OJT individuals concerning their skills as practicing cytotechnologists. This study may contribute insight into this area since the certification examination evaluates not only the didactic but also the diagnostic skills necessary in cytotechnology.

Some relevant studies have been conducted in laboratory areas related to cytotechnology. In the field of medical technology, a study was conducted to investigate the effect of various configurations of preprofessional science courses on student achievement in professional courses and on a

national certification examination. The independent variables for the study were the two chemistry options offered by Ohio State University at the time of the study. The dependent variables were the student's final grade in professional courses and the certification examination scores in four subject areas: clinical chemistry, hematology, clinical microbiology and blood bank/immunology.

Findings showed that: 1) Student performance in preprofessional courses and certification examination in four content areas was not significantly influenced by selected preprofessional science course configurations. 2) Student performance in professional coursework in the four content areas was not significantly influenced by choosing either of the two chemistry course options. 3) Student performance on the certification examination in the four content areas was significantly influenced by selection of one of the chemistry course options. In the areas of clinical chemistry, hematology and clinical microbiology, students who chose the biochemistry option performed better than students who chose the physiological chemistry option though these students scored lower in the blood bank/immunology area (Lin, Snyder, Agriesti-Johnson, Powers, 1987).

In a study conducted in the area of respiratory therapy to correlate selected program characteristics with the pass rate on the respiratory therapy certification examination, researcher, Gary Allen found that there was: 1) a

correlation between the curriculum resources and clearly defined objectives and the positive affect on student performance. "Current research indicates that classroom objectives directly related to learning tasks, and clearly defined for the students has a positive impact on achievement". 2) Instructor qualifications, and advanced knowledge of the subject matter is also a positive influence. 3) Certain instructional techniques have resulted in significantly higher pass rates. Some examples are: returning major tests in 1 day or less, extensive use of multiple multiple type test questions, frequent use of unannounced quizzes, using tests that are always comprehensive as opposed to a comprehensive final only (Allen, 1986).

Unlike the above mentioned study in medical technology, data correlating the effect of preprofessional courses on cytotechnology training achievement is not available. The importance of preprofessional courses and how they affect the proficiency that is vitally important in the field of cytotechnology has not been documented. Unlike Mr. Allen's study in respiratory therapy, the effect of teaching methods and teacher qualifications on the training in cytotechnology programs has not been found by this researcher.

Importance of Proficiency

Proficiency in the cytology laboratory is of extreme importance. Unlike many other areas of clinical laboratory science that diagnose specimens and run a control for

comparison, cytology is a totally subjective diagnosis made by the cytotechnologist in comparison to a set of visual criteria that each normal cell must meet to be diagnosed normal. When a case is diagnosed normal the cytotechnologist is the only person to ever screen that specimen (excluding the 10% of normal slides periodically screened by most laboratories for quality control). Therefore, it is critically important that our educational system assure sufficient proficiency.

Charles N. Carney in his article, " Quality Control in Cytotechnology: A System for Simultaneous Monitoring of Accuracy and Education and for Proficiency Testing", has suggested guidelines for quality controlling accuracy and education in cytopathology. He postulates that the maintenance of accuracy provides constant education for the learning pathologist and the learning cytotechnologist. The interlaboratory discussion of a particularly interesting or puzzling cytology specimen alone provides situations for cellular criteria reinforcement and philosophical differences. Correlation between cytology samples and histological tissue samples provides an opportunity for the student to understand the clinical significance of their work in cytology. Difficult and unusual cases contribute to the need for research projects.

Carney stated that the proficiencey of the cytotechnologist is the most important factor in the field of cytopathology. "Their role in specimen preparation,

screening and interpretation is by far the predominant function of the laboratory" (Carney,1984). There is a need for concrete and easily understood evidence of proficiency. Carney lists the criteria agreed upon in the profession for measuring a cytotechnologist's proficiency "e.g. the cytotechnologist shall screen in a certain way, should dot certain areas, should present slides with certain degrees of atypia to a pathologist, should reject inadequate specimens and poor stains, etc" (Carney, 1984). Certain infractions of the above criteria would provide information on proficiency. Dr. Carney outlined:

> (1) The interpretation of a case as benign when there are obvious suspicious or malignant cells. (2) Interpretation of a case as suspicious or malignant when it is obviously benign; and (3) the failure to see (dot) suspicious or malignant cells (if there are one to five suspicious or malignant cells or areas, all should be dotted; for a larger number, dots considered representative are acceptable) (Carney, 1984).

A decision is made as to the number of infractions allowed per year and each screener is monitored to assure that that margin of error does not increase. Carney feels that quality control of cytotechnologists' proficiency works because of the vast numbers of cytotechnologists dedicated to accuracy and because there exists an interprofession communication in the cytology laboratory.

One of the variables involved in proficiency is supply and demand. The effects of undersupply of properly trained individuals in an already overloaded field of work were discussed at hearings in Washington, D.C. in the Clinical Laboratory Management Association Newsletter in the article "First Of The 1988 Congressional Hearings Blasts Lab Quality" the situation of supply meeting demand in the field of cytotechnology is one of the many issues under testimony. The hearing members were "warned that there is a growing and critical shortage of qualified cytotechnologists" (Foster, 1988). There are currently 47 accredited cytotechnology programs nationally, only 39 of which are presently active (ASC, Subcommittee for Student Recruitment, 1988). Many of these active programs have not been filled to capacity. The ever present demand for cytotechnologists is rapidly outgrowing the supply. The continuous workload is falling with increasing weight on the shoulders of a decreasing number of qualified professionals and thus, becoming overwhelming. Currently, it is estimated that "20%-40% of the Pap smear interpretations are misdiagnosed" (Foster, 1988). The proficiency of the cytotechnologist is under attack. The federal government is intervening to set new regulatory standards in every aspect of the clinical laboratory including cytotechnology.

Summary of the Literature

In the literature, discussion of the perception of the baccalaureate degree on the cytotechnologist is discussed

but no hard data has been evaluated to verify that the baccalaureate degree produces a better cytotechnologist. Some other areas of allied health have collected data on certain program characteristics and their effect on the certification examinations for those fields. No such data was found to correlate the educational prerequisite courses, program training, teaching methods, or teacher qualifications with the effect that these variables have on the graduate cytotechnologist's performance on the national certification examination. In addition, proficiency has been discussed and criteria for evaluating proficiency have been proposed but with the ever increasing workload and the ever decreasing supply of trained and certified cytotechnologists the accuracy of cytological diagnoses is now coming into question.

Chapter III

Methodology

Description and Research Design

This nonexperimental, correlational research paper was designed to determine the relationship between attained certification examination scores in cytotechnology (the dependent variable) and selected program characteristics and student enrollment patterns (the independent variables). It was proposed that certain program characteristics, for example: teaching methods, types of tests used, teacher training background and teacher related work experience would have an effect on the student scores attained on the cytotechnology certification examination.

Selection of Subjects

The subjects from which the information was gathered were the education coordinators of the 47 cytotechnology programs in the United States. The names and addresses of the programs and the education coordinators were obtained from the most recent listing provided by the American Society of Cytology in Philadelphia, Pennsylvania.

Procedures

A self-developed instrument, with items of both closed and open form, was constructed to gather information (see Appendix A-2 to A-8). The instrument was reviewed by a panel of peers in allied health and education. Suggested revisions were made and the final draft of the instrument

was considered appropriate for obtaining the necessary data in this study.

The self-developed questionnaire was mailed out to the education coordinators of the cytotechnology programs across the nation. Accompanying the questionnaire was a self-addressed, stamped envelope for returning the completed survey and a cover letter defining the research project and requesting the return of the questionnaire within two weeks time (see Appendix A-1). A self addressed stamped postcard was also included for those requesting a copy of the evaluated data. Those not responding within the time frame indicated in the cover letter received a second questionnaire and an accompanying reminder letter (see Appendix A-9).

The survey included questions concerning many aspects of program and student enrollment patterns. Items addressing such areas as: 1) methods employed in the instruction of the students, 2) teacher qualifications; teacher training and work experience, 3) the number of pathologists (M.D.'s) involved in student instruction and the extent of this involvement, 4) the student grade point averages (GPA) required for admission into cytotechnology programs and 5) the student GPA required for retention in the programs were asked. Questions pertaining to the population of students enrolled, the program's student capacity, the placement rate of students in the work force and the distance from which requests had come to the

schools from across the nation for cytotechnologists to fill available positions, were included. Finally, questions concerning the student's performance on the August, 1987 certification examination, the percent of students who passed on the first try and the degree held by those students (associate or baccalaureate) were also asked.

There were 30 respondents to the questionnaire. Only 27 of the surveys, however, were completed. Three uncompleted surveys were returned because the schools had been inactive for several years and the coordinators felt they were not able to contribute any relevant data.

Data Analysis

The data were compiled onto a Lotus spreadsheet and analyzed by computer using SPSS. Frequencies were performed on each of the survey questions to determine percentages for each item of the instrument. Chi Squares were included to evaluate questions which required a yes or no response. Pearson-Product Moment Correlation Coefficient was used to determine if there was a linear relationship between mean certification examination scores and program characteristics (e.g. GPA, teacher qualifications, work experience). A pooled t-Test was tabulated to examine the relationship between the mean certification score for the associate degree cytotechnology students and the mean certification score for bacclaureate degree cytotechnology students. A pooled t-test was also

calculated to compare the mean school certification score for hospital based programs and the mean school certification score for university based programs. An analysis of variance (ANOVA) was performed on all questions to determine if there were differences in the mean certification examination scores based on different program characteristics. The data were evaluated and the results are presented here.

Chapter IV

Analysis of Findings

A 32 question self-developed survey instrument (see Appendix A2 - A8) was sent to each of the 47 cytotechnology programs in the United States. Each education coordinator was asked to complete the entire questionnaire, answering all the questions indicated on the instrument. Of the 47 programs contacted, 8 had become inactive. Twenty-seven of the 39 active programs completed the survey instrument. This produced a survey sample size of 39, with 27 respondents for a total return of 69%.

Findings Related to the Research Questions

The research questions in this study dealt with an investigation into the program characteristics and student enrollment patterns in schools of cytotechnology across the United States. Each of the 32 questions was evaluated for its significance of correlation to the mean certification examination score attained. The level of correlation was assessed by utilization of SPSS and Lotus software programs. Graphics were used to represent various program characteristics. Each respective research question is presented below with a discussion of the findings.

Research Question #1

What was the relationship between student program level and certification examination scores attained?

Evaluation of question #12 of the survey instrument was

intended to answer this research question. The participants were asked to provide the school's mean score on the certification examination for associate degree students and the mean scores for bachelors degree students for 1987. Four of the 27 schools completing the survey provided mean certification examination scores (ranging from 158 to 174) for cytotechnology students with associate degrees. Twenty of the 27 schools provided informaton about mean scores (ranging from 140 to 182) for students who had bachelors degrees. A pooled t-test was performed to determine if there was a significant difference in the means of the certification examination scores attained by associate degree students and mean scores attained by bachelors degree students. The t-test yielded a t of 0.59, $p<.05$.

Research Question #2

What was the relationship between instructional methods used and attained certification examinaton scores?

Participants were asked questions concerning the teaching methods used, the types of test items employed and the order in which the subject matter was presented in their program (items #25, #26, #27 of the instrument). All of the respondents reported including lecture, written tests, kodachromes and unknown slides as part of their program's teaching methods. Other teaching techniques were used with varying frequency depending on the institution (see Figure 1). Of multiple choice, true and false, matching, fill-in and essay type test questions, all the programs reported using multiple choice and matching questions on their written student examinations (see Figure 2). Twenty-six (96.3%) of the respondents indicated that the order in which the students were presented the subject matter began with nornmal gyn cytology. Table 1 lists the various orders of course material presentation reported by the schools and the frequency of each variation. On evaluation of this data by Pearson-Product Moment Correlaton Coefficient and Analysis of Variance (ANOVA) it was found that teaching methods, types of tests used and the order in which the subject was presented resulted in no statistically significant difference in certification examination scores among programs.

Questions involving the variety and length of

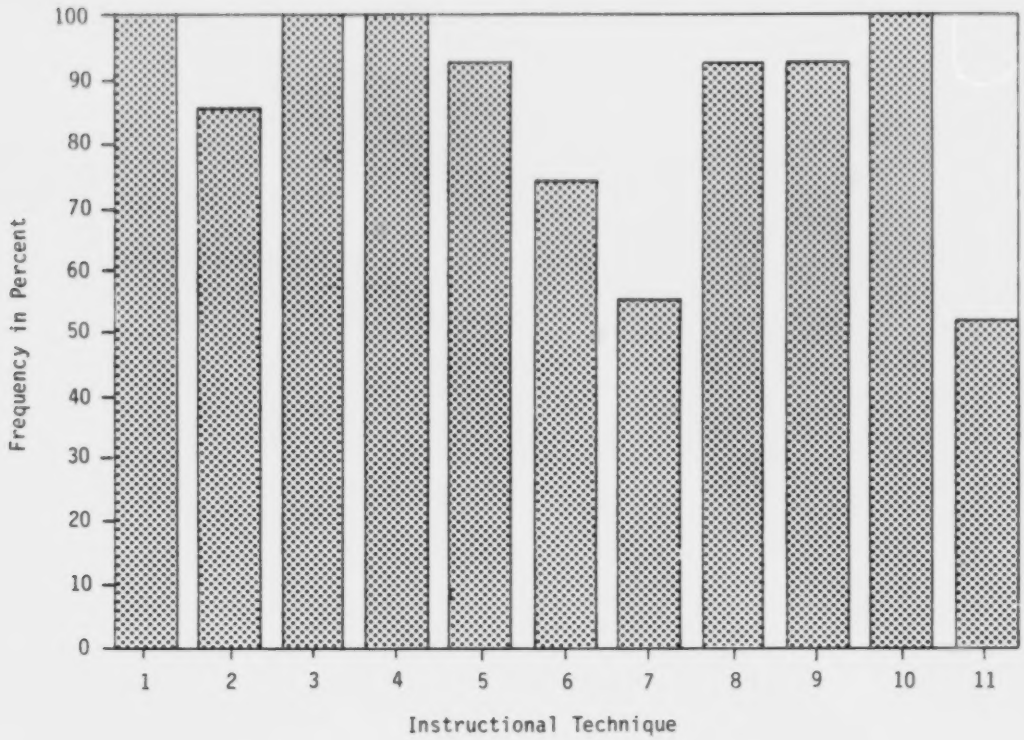

Figure 1. The instructional methods employed by cytotechnology programs throughout the United States are represented by frequency of use.

1. Lectures
2. Written quizzes
3. Written tests
4. Kodachromes
5. Color plates
6. Simulated registry
7. Oral quizzes
8. One-on-one, double headed microscope
9. Multi-headed microscope
10. Unknown slides for diagnosis
11. Other (video tapes, films, conferences, workshops, journal reports, teleconferences, self-paced instructional units, research projects, case studies)

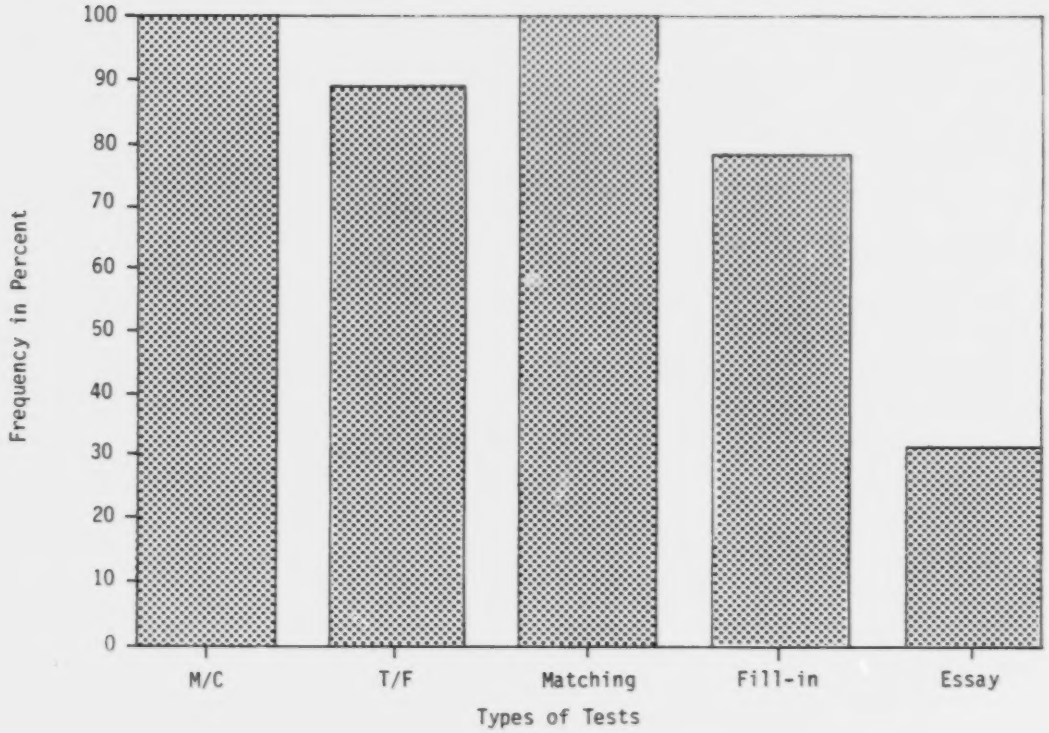

FIGURE 2. The types of tests used in cytotechnology programs are represented according to frequency of use for the schools. (M/C = multiple choice, T/F = true and false).

TABLE 1. Cytotechnology Subject Matter: Order of Presentation

Subject Matter	Variation in order of subject matter presentation for cytotechnology programs responding.															
Normal Gyn	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Abnormal Gyn	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Respiratory	3	3	4	3	3	3	3	3		3	3	3	3	3	3	3
Urinary	6	5	6	6	5	4	5	6	3	5	4	6	4	4	5	4
Fluids	7	4	5	4	4	5	6	5	4	4	5	4	6	5	7	5
Needle Asp	5	6	7	5	6	6	7	7	5	7	**	7	7	**	6	7
Other	4	7	1	7		7	4	4	6	6		5	5	6	4	6
Percent of schools in each variation	1%	1%	1%	1%	3%	4%	3%	1%	1%	1%	1%	2%	3%	1%	1%	1%

Other = head and neck, management, research, basic concepts in cytogenetics, histology, bone, oral technical writing.

** Needle aspiration taught with each subject area.

student clinical experiences and their affect on the certification examination scores students attained were also asked (items #23 and #24). The most common clinical rotation pattern reported by fifteen (55.6%) of the schools responding indicated a 12 month clinical rotation for their students, at a single facility. Again, significant correlations were not observed when Pearson-Product Moment correlations of the student clinical experience(s) were related to student certification examination performance.

Research Question #3

What was the overview of the program characteristics of the cytotechnology programs in the nation?

Evaluation of the data obtained from questions #15-22 and #25-27 of the survey were designed to answer this research question. The participants were asked to indicate the educational backgrounds and years of work experience for all the individuals directly involved with cytotechnology student instruction. As demonstrated by the Pearson-Product Moment Correlation Coefficient, neither educational background nor work experience for the instructional staff had a significant correlation with the certification examination scores attained.

The most frequently reported educational background for individuals involved in instruction of students reported by 8 (29.6%) of the programs were individuals who held MA/MS degrees and a CT certification. The overall percent breakdown in educational background for individuals involved in cytotechnology student instruction is shown in Figure 3. Twelve schools (44.4%) reported that some of their faculty had teaching degrees. Ten schools (37%) reported that the work experience for their teaching staff fell in the 5-8 year range (see Figure 4).

The number of faculty varied from school to school. The range was from 2 (one program) to 43 (one program).

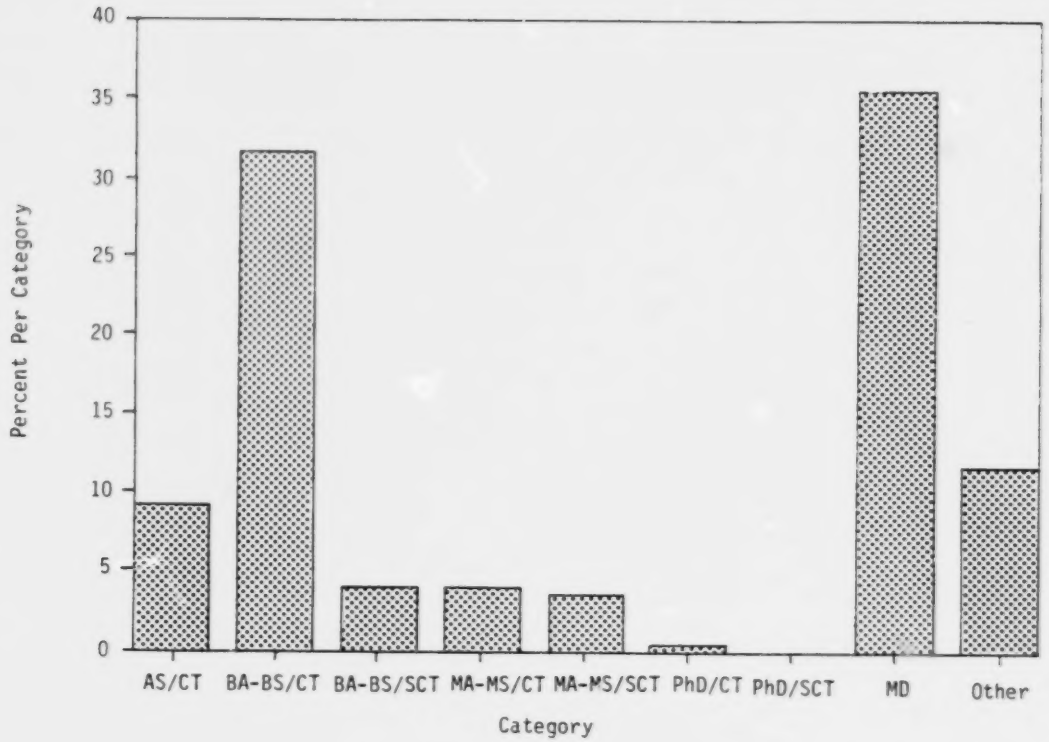

FIGURE 3. The variety of educational backgrounds for instructors in cytotechnology is demonstrated.

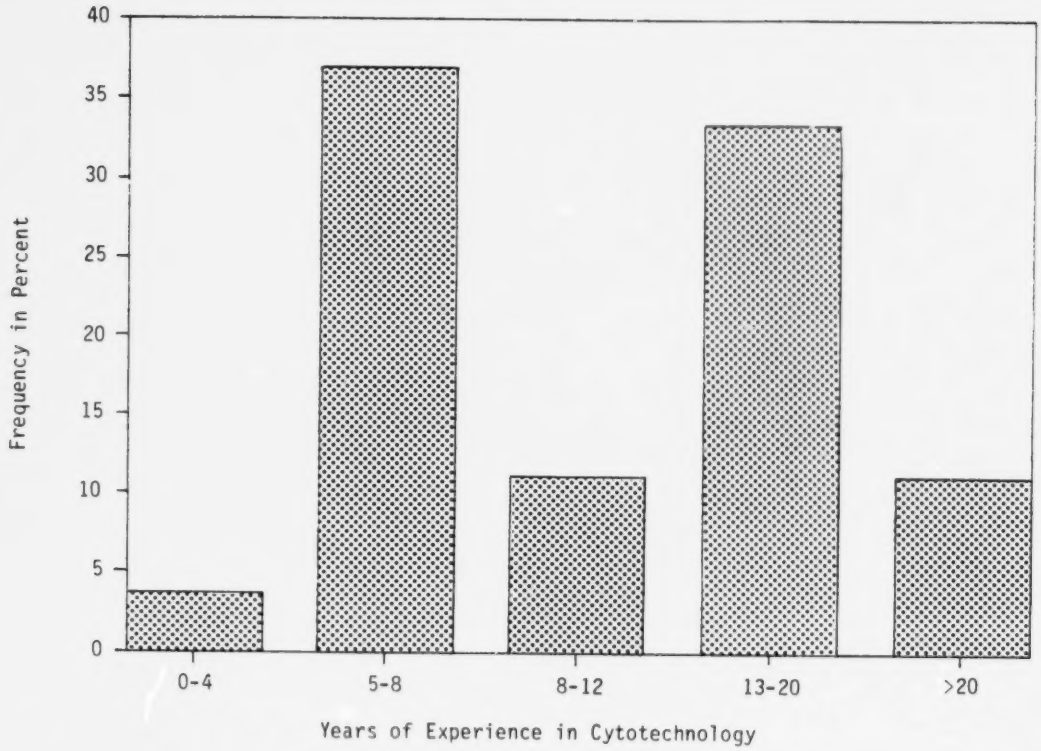

FIGURE 4. Work experience, in percent, for individuals involved in the instruction of students in cytotechnology programs is shown.

Four schools (14.8%) had 9 individuals involved with student instruction. Four (14.8%) of the schools reported 4 individuals involved with student instruction (see Figure 5). The average faculty to student ratio was 3.4 to 1 with the highest being 14.3 to 1 and the lowest being 0.5 to 1.

Questions concerning the involvement of pathologists in student instruction were included. The number of pathologists involved in student instruction varied. The range was 2 pathologists reported by 7 programs and 3 pathologists reported by 7 schools to 17 pathologists reported by 1 school. The most frequent number of pathologists involved in instruction was 3 indicated by 7 (33.3%) of the respondents and 2 also reported by 7 (33.3%) of the respondents (see Figure 6). Twenty-six (96.3%) of the programs reported pathologist involvement in the didactic training of the students and 23 (85.2%) reported pathologist involvement in microscopic collaboration with the student. The average pathologist to student ratio was 1.56 to 1, with the highest ratio being 5.66 to 1 and the lowest ratio being 0.125 to 1. Neither the number of pathologists giving students attention nor the extent of involvement the pathologists had with the students produced a significant correlation with obtained certification examination scores. Students from schools in which the pathologist(s) spent little time instructing attained scores similar to schools reporting a greater amount of involvement by the

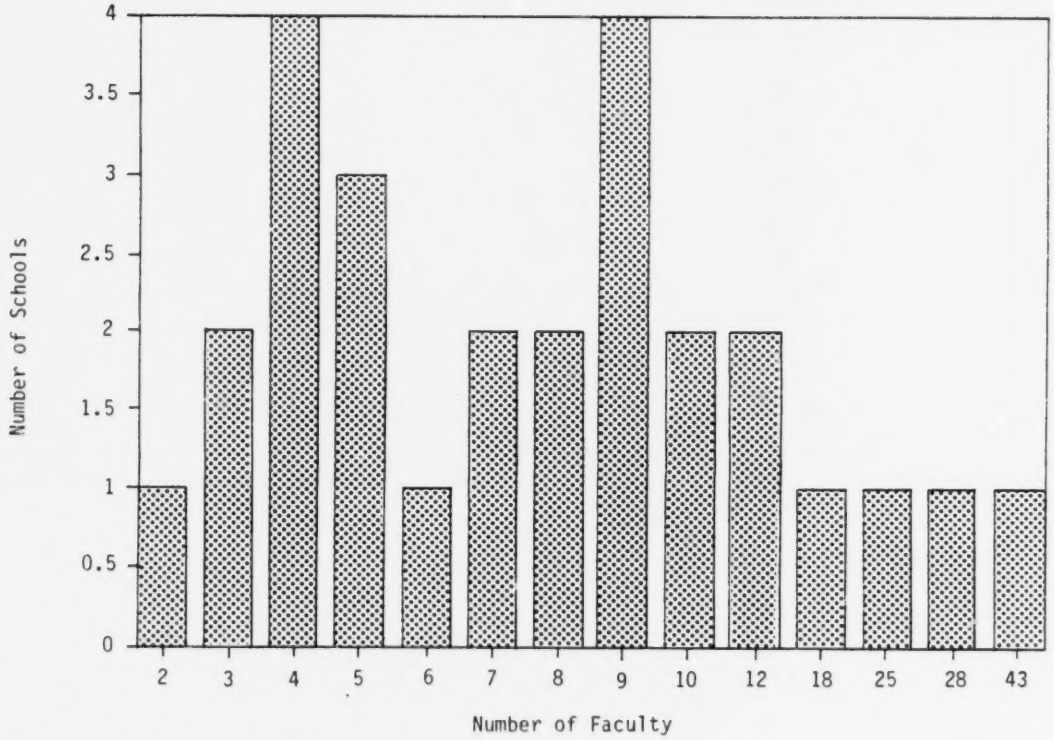

FIGURE 5. This figure shows the range of instructors involved in cytotechnology programs and the number of schools that have each specific number of faculty.

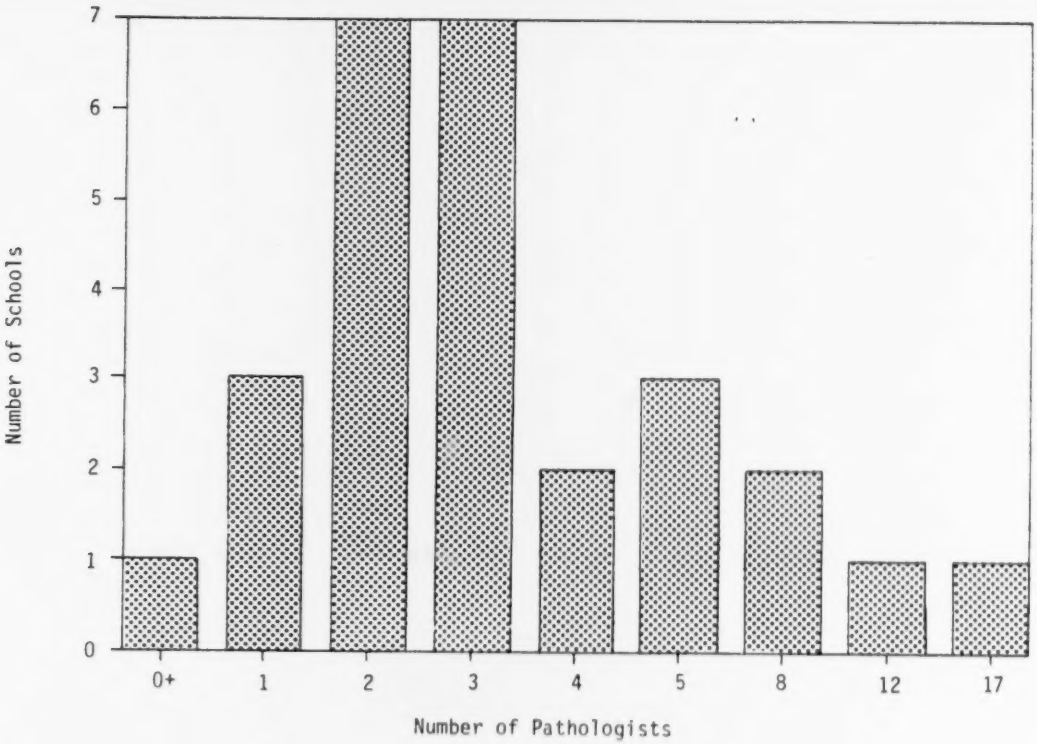

FIGURE 6. This figure demonstrates the range of pathologists involved in cytotechnology programs and the number of schools having each specific number of pathologist in their program.

pathologist(s) in student instruction.

The grade point averages (GPA) for admission into the program and for retention in the program varied. The most frequently reported GPA for admission into cytotechnology programs was 2.5, reported by 12 (44.4%) of the schools. The most frequently reported GPA allowing student continuation in cytotechnology programs was 2.0, reported by 13 (48.1%) of the schools (see Table 2). When analyzed by Pearson-Product Moment Correlation Coefficient and ANOVA neither admission GPA nor continuation GPA had a significant correlation with the certification scores attained.

TABLE 2. MEAN SCHOOL CERTIFICATION EXAM SCORE AND GRADE POINT AVERAGES

School	Associate Scores	Bachelors Scores	Admission GPA**	Maintenance GPA***
1*	160	176	NA	2.75
2		170	2.5	3.0
3*		162.5	2.8	NA
4		NA	1.85	2.0
5		143	2.5	2.0
6		164	2.5	2.0
7		146	2.0	2.0
8		NA	2.0	3.0
9		NA	2.5	2.0
10		NA	2.5	4.0
11		152.7	3.0	3.0
12		NA	2.0	2.0
13		156	2.5	2.5
14	168	166	2.0	2.8
15		154	2.5	2.0
16*		150	2.0	2.0
17		177	2.0	2.5
18		168	2.75	2.0
19		182	2.5	2.5
20		142	3.0	NA
21*	158	172	2.5	2.5
22		152	2.5	2.0
23		NA	2.5	2.0
24*	174	170	3.0	2.5
25		140	2.0	2.5
26*		NA	2.0	2.5
27		176	NA	2.0

NA Not available
* Hospital Based Program
** Grade Point Average required for program admission.
*** Grade Point Average required for student program continuation.

Research Question #4

What was the national pattern of student enrollment in cytotechnology?

Questions #2 and #3 of the survey instrument dealt with present enrollment and student capacity. The student enrollment reported by the 27 responding schools was 101. The student capacity reported by the 27 active schools responding was 192. Thus, these schools are operating at 52% capacity.

Question #1 of the survey instrument was concerned with the type of program offered. Twenty-one (78%) of the schools responding to the survey were university based or affiliated programs. Six (22%) of the programs responding were hospital based cytotechnology training programs (see Table 2). When this data was entered into a Pearson-Product Moment Correlation Coefficient neither type of program exhibited a significant correlation with certification examination scores. The total number of students enrolled in the university based or affiliated programs was 84 (83%) and in the hospital based programs was 17 (17%). The mean registry score for the hospital based programs completing the survey instrument was 165.3 and for the university based programs was 159.8. The t-test performed on this data yielded a t of 1.04, $p<.05$.

Research Question #5

What was the perceived employment outlook for the graduating cytotechnology students?

Twenty-five (92.6%) of the schools responding to item #29 reported 90-100% of their students were placed in jobs by graduation. Seventeen (63%) of the schools responding to item #30 reported 75-100% of their students still working in the field of cytotechnology. Of the 19 schools responding to question #32 of the survey instrument the average distance from which requests for graduating students have been received was 2700 miles. Twenty-two (81%) of the schools provided information concerning the number of students that the school could place were their program capacities larger (item #31). The range of additional students each school could place if their programs were larger, ran from 4, the lowest estimate, to 200, the highest estimate. The mean number of additional graduates that could be placed was 24.

Interpretation of Findings

The pooled t-test performed on the attained certification examination scores for the associate degree students and the attained scores for the baccalaureate degree students at a significance of $p<.05$ indicates that there was no difference between the mean score attained by the associate degree students and the mean score attained by the baccalaureate degree students. Although the sample size was small, this data lent support to the hypothesis that the educational background of the associate degree student may be sufficient to prepare an individual for a career in cytotechnology. Though the perception of education coordinators and other cytotechnologists in Dr. Karps article indicate that professionals within the field view the bachelors degree as important in upward mobility and change for the cytotechnologist (Karp, 1979); the data in this study suggests that the proficiency, which is so important for the "screening" cytotechnologist in the cytology lab, is not profoundly affected by the level of education.

A comparison made between preprofessional courses and professional courses conducted by the Ohio State University medical technology program (Lin, Snyder, Agriesti-Johnson, Powers, 1987) were not available in the field of cytotechnology. The variety of preprofessional courses allowed for admission into cytotechnology programs prior to August 1988 and the prior success rate for cytotechnologists

on the certification exams suggests that the increased number of standardized preprofessional courses now established by the ASCP might be unnessary.

Unlike a study conducted in the field of respiratory therapy, no statistical significance was found between teaching methods, types of tests used, the order in which the material was presented and the attained certification examination scores. Gary Allen (Allen, 1985) found that certain teaching techniques and types of test questions did have a significant affect on the pass/fail rate of students on the certification examination in respiratory therapy.

Teacher qualifications have a strong positive affect on student performance on the certification examination in the field of respiratory therapy (Allen, 1985). Teacher educational background and work experience demonstrated no significant correlation in the field of cytotechnology with attained certification examination scores. Furthermore, student/faculty ratio had no effect on the student scores attained. The student/pathologist ratio and the degree of involvement the pathologists had with the students demonstrated no significant difference in attained certification score outcomes for students.

As shown in Table 2, the GPA for admission into cytotechnology programs varied; as did GPA's for continuation in the cytotechnology programs. The GPA for admission into cytotechnology programs and the GPA for continuation in the cytotechnology programs produced no statistically significant

correlation with the certification examination scores attained in each program.

Twenty-two of the respondents were university based or affiliated programs accounting for 84 of the students enrolled nationally in cytotechnology programs. Six schools reporting were hospital based programs accounting for 17 of the students enrolled nationally. The number of university trained cytotechnologists lends support to Catherine Keebler's prediction that cytechnologists of the future would receive their cytotechnology training in the university setting (Keebler, 1977). However, the t-test result, at a significance of, $p<.05$ suggested that cytotechnology graduates from the university based or affiliated programs scored the same on the certification examination as the cytotechnology graduates from hospital based programs.

Nineteen of the schools responded to question #32 of the instrument. Each school estimated the distance in miles from which they had received requests for cytotechnologists to fill vacant positions. The mean distance for all the schools reporting was 2700 miles. This emphasizes the critical shortage of trained certified individuals in the field emphasized at the 1988 Congressional Hearings in Washington (Foster, 1988).

Each school estimated the number of extra students they could place if their program capacities were increased. The mean number of additional students for each school reporting was 24. Therefore, in order to meet the demand for

cytotechnologists in the field today, the total school capacity must be increased by more than 300% and the total student enrollment must be increased by more than 600% for the responding schools. Such data provides evidence to support the warning concerning the critical shortage in the field. This critical shortage is considered to be a contributing factor to the 20-40% error rate in screening cytology smears (Foster, 1988). Increased numbers of trained certified individuals are indicated.

Chapter V

Summary and Conclusions

This research involved an investigation into the correlation between program characteristics, student enrollment patterns and the scores students attained on the certification examination in cytotechnology. A self-developed survey instrument was constructed and sent to the education coordinators of all the cytotechnology programs in the United States to obtain information which would address the research problem. Data was collected in an attempt to analyze whether level of education (associate degree or bachelors degree) has an impact on student achievement on the certification examination. Information concerning teaching methods, tests used, the order in which course material was presented and how they affect student achievement on the certification examination was gathered. Program characteristics including: the number of individuals involved in student instruction (cytotechnologists and/or pathologists), their educational backgrounds and work experience and how this affected scores that students obtain on the national certification examination was obtained. The kind of impact program characteristics, student enrollment patterns and the successful achievement of national certification might contribute to employment in the field of cytotechnology was explored.

The following limitations were inherent in the study.

1) The data were representative of only the schools that

responded. Not all of the active programs responded to the instrument.

2) Questions left unanswered affected the outcome of the data for those specific topics. In areas, such as, actual certification scores and information concerning the associate degree student, questions were left unanswered.

3) Two questions were interpreted in more than one way by some of the respondents.

4) Questions concerning certification examination mean scores were too limited. Questions needed to be asked concerning certification scores attained by the individual programs over several years.

The response sample for the associate degree student was small. When correlating the mean certification scores obtained by associate degree students and the mean certification scores obtained by bachelors degree students, the pooled t-test produced a 0.59 result at $p<.05$ indicating that the two means were not different. This gives support to the hypothesis that the bachelors degree students performed no better on the national certification examination than did the associate degree students.

A variety of teaching methods are employed in each of the programs. Most schools included the same approaches to instruction. Some schools incorporated the same approaches as other schools plus some techniques unique to their facility. For the most part all schools reported using the

same types of test items. However, some schools did not use true and false items and some did not employ essay questions. Normal gyn material is presented first in the curriculum by all but one program. Nonetheless, there was no evidence that any instructional technique, type of testing used or order of subject matter presentation produced a significant relationship to performance on the certification examination.

The schools reported a variety in the number of individuals involved in student instruction. The educational qualifications and the work experience backgrounds of the instructors varied. The number of pathologists and the extent of their involvement with student instruction differed throughout the programs responding. The GPA scores for admission into the program ranged from 3.0, the highest to 1.85, the lowest. The most frequent GPA score reported for admission into the program was 2.5. The range of GPA scores reported for continuation in the program ran from 4.0, the highest to 2.0, the lowest, with one school reporting no set GPA for maintenance in the program. The most frequent GPA reported for continuation in the program was 2.0 (see Table 2). However, instructor qualifications, pathologist involvement and GPA provided no significant correlation with student performance on the national certification examination.

The majority of the programs responding to the instrument were university based or affiliated programs. The largest population of students also stemmed from the university based

or affiliated programs. Therefore, it appears that most cytotechnologists in the next decade, if trends remain as they are, will obtain there cytotechnology training in university based programs.

Schools reported receiving requests for cytotechnologists an average of 2700 miles from their programs. Schools reported that on the average they could place 24 more students in jobs across the nation. Several coordinators commented on the critical shortage of trained, certified cytotechnologists available today. Presently, the field is wide open. Job openings are available in most states in the union and lengthy listings can be found in several of the professional magazines.

Implications and Recommendations

Some areas of the field of cytotechnology are in need of further study. One area to be addressed is whether or not academic level has an overall affect on the student's performance on the certification examination. Data should be collected over the past several years and correlations tabulated and student performance documented. It is possible that increasing the educational requirement for certification examination eligibility might also be contributing to the supply/demand problem in the profession.

Many of the university based programs offer a diversity of study and include other laboratory training in their cytotechnology curriculum. Further study is suggested in this area to monitor whether the more broadly trained

bachelors degree individuals remain in the profession or take employment in one of their areas of diversity. A comparison of the attrition rate for bachelors degreed cytotechnologists and non-bachelors degreed cytotechnologists is necessary. The more highly educated and diversified programs may also be a contributing factor to the field's supply/demand situation.

Investigation into job satisfaction of cytotechnologists presently working in the field and exploration of the reasons for attrition in the field are needed. Research into the new areas former cytotechnologists enter when leaving the field requires study. The affect that this attrition rate has on the annual openings in the field should be included. The number of openings that are new positions and the number of openings in cytotechnology resulting from attrition deserves exploration.

Of immense importance, because of new federal regulation coming on the horizon, individuals in the profession, not just professional agencies, need to be more actively involved in the Washington process. Guidelines affecting regulatory control in the laboratories should be sent out for review and comment by the individuals presently working in the field before Congressional laws are passed regulating the cytotechnologist and the cytology laboratory. Professionals need to have a say in the future of their profession from the educational beginnings to the last job held in that profession.

The great distances reported by the responding schools

from which requests for cytotechnologists come and the estimated further placement programs feel they could handle if their programs were larger, suggests a strong need for recruiting and improved public relations techniques. The public needs to know about cytechnologists and the role they play in the early diagnosis of cancer. Interest needs to be generated in this important branch of diagnostic medicine and the best possible people recruited for training in the profession. Only the continued existence and encouragement of quality schools and training programs in cytotechnology will ensure ongoing replenishment of the necessary individuals who work in the area of early cancer detection for early treatment, the cytotechnologist.

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APPENDIX

June 17, 1988

Dear Education Coordinator:

Your position in allied health is an important one and your concern for your students and the field of cytotechnology is demonstrated by the position which you hold. As you are certainly aware, the educational program you provide and the students you teach result in producing the best possible cytology background for prospective professionals in the field.

I am working on my thesis for the Master of Occupational Education at Ferris State University, in Big Rapids, Michigan. I am investigating select program characteristics and their correlation with passing the registry. This study will include all the cytotechnology schools in the United States.

I'm not presently working in the field but have tried to keep aware of what's happening both nationally and here in Michigan. With this year's ASC projections of 131 possible graduates and 220 available positions nationally it is obvious that the need for trained, registered cytotechnologists is becoming critical. The importance of the program of training and the possibility for each student to pass the certifying exam is also critical in helping to fill the demand.

You do not need to sign the questionnaire and be assured that your response will remain anonymous and confidential.

Please answer all the questions to the best of your ability and return the completed questionnaire to me in the enclosed self-addressed, stamped envelope by July 1, 1988.

If you wish a summary of the study, please indicate by returning the enclosed postal card.

Thank you for your time.

Sincerely,

Carol A. Paquette, B.A. CT(ASCP)

Cytotechnology

Education Survey

Please respond to the following questions:

1. What type of cytotechnology program do you offer? (Please check one.)
   - [ ] Diploma
   - [ ] Certificate
   - [ ] Degree
   - [ ] Degree and Diploma/Certificate

2. How many students are currently enrolled in your program? (Please write in a number.)
   [ ]

3. What is the maximum enrollment for your program? (Please write in a number.)
   [ ]

4. What grade point average (GPA) is required for acceptance into your cytotechnology program? (Please write in a number.)
   [ ]

5. What percent of your students completed the cytotechnology program? (Please fill in the percent.)

Associates degree holders		Bachelors Degree holders	
1987	[ ]	1987	[ ]
1986	[ ]	1986	[ ]
1985	[ ]	1985	[ ]
1984	[ ]	1984	[ ]
1983	[ ]	1983	[ ]

6. In your opinion why did some students fail to complete your program? (Please check <u>all</u> appropriate responses.)
   - [ ] the curriculum was too difficult
   - [ ] the student did not have the necessary skills
   - [ ] the student's educational background was insufficient
   - [ ] the faculty are too demanding
   - [ ] the student was not suited to the confinement of concentrated microscope work.
   - [ ] the student found the material uninteresting
   - [ ] the student found the material non-challenging
   - [ ] other _____

7. What is the minimum grade point average (GPA) students must maintain to continue in your program? (Please write a number.)
   [ ]

8. How many students in the past 5 years had earned Associate degrees before they enrolled in your program?
   [ ] All
   [ ] 3/4
   [ ] 1/2
   [ ] 1/4
   [ ] Less than 1/4
   [ ] None

9. How many students in the past 5 years had earned Baccalaureate degrees before they enrolled in your program? (Please check.)
   [ ] All
   [ ] 3/4
   [ ] 1/2
   [ ] 1/4
   [ ] Less than 1/4
   [ ] None

10. What percent of your graduates go on to become certified? (Please check.)
   [ ] 80 - 100%
   [ ] 60 - 79%
   [ ] 40 - 59%
   [ ] 20 - 29%
   [ ] 0 - 19%

11. Over the past 5 years, what percent of students in your program, who passed the registry exam on the first try held: (Please fill in the percent.)

   [ ] An associate degree
   [ ] A bachelors degree

12. What was the average registry score in August 1987 for students in your program who held: (Please fill in the number.)

   [ ] An associate degree
   [ ] A bachelors degree

13. If appropriate, indicate the year you stopped accepting associate degree students into your program?
   [ ] 1983
   [ ] 1984
   [ ] 1985
   [ ] 1986
   [ ] 1987
   [ ] Not applicable

Please skip to question #15 if not a BACCALAUREATE DEGREE PROGRAM

14. What percent of your entering students hold:
    [ ] a high school diploma only
    [ ] an associate degree
    [ ] a bachelors degree
    [ ] transferred from other institutions

15. Indicate the number of faculty/instructors in your program. (Please include both institutional and adjunct faculty/instructors in this number.)
    [ ]

16. Indicate the number of faculty/instructors in your program who have the following credentials.
    [ ] AS, CT
    [ ] BA/BS, CT
    [ ] BA/BS, SCT
    [ ] MA/MS, CT
    [ ] MA/MS, SCT
    [ ] Ph.D, CT
    [ ] Ph.D, SCT
    [ ] MD
    [ ] Other:_____

17. Do any of your teaching staff have education degrees? Please check.)
    [ ] Yes, most of the faculty/instructors.
    [ ] Yes, some of the faculty/instructors.
    [ ] No

18. How many members of your teaching staff who do not hold education degrees, have taken any courses in education? (Please indicate the number.)
    [ ]

    * If your answer was one or more in question 18, please estimate the average number of education credits.
    [ ]

19. Indicate the average number of years of cytology work experience for your teaching staff?
    [ ] 0 - 4 years
    [ ] 5 - 8 years
    [ ] 9 - 12 years
    [ ] 13 - 20 years
    [ ] More than 20 years

20. Indicate the number of pathologists involved in your program?
    [ ]

21. Indicate the number of pathologists in your program who are trained cytopathologists?
    [ ]

22. Indicate the ways in which the pathologist is actively involved in student education? (Please check all that apply.)
    [ ] Didactic teaching
    [ ] Laboratory techniques
    [ ] Microscope collaboration
    [ ] Other:_____

23. How many clinical experiences do your students have?
    [ ] One, at this facility.
    [ ] One, at a facility separate from this facility.
    [ ] More than one.

    *If you answered more than one in question 23, indicate how many?
    [ ]

24. How long is your cytology internship (clinical rotation). (Please check one.)
    [ ] Less than 12 months
    [ ] 12 months
    [ ] More than 12 months

    *If you answered more than 12 months in question 24, indicate how long.
    [ ]

25. What methods of instruction do you employ in your program? (Please check all the appropriate answers.)
    [ ] Lectures
    [ ] Written quizzes
    [ ] Written tests
    [ ] Kodachromes
    [ ] Color plates
    [ ] Simulated registry
    [ ] Oral quizzes
    [ ] One-on-one at the double-headed microscope
    [ ] Multi-headed microscope sessions
    [ ] Unknown slides for diagnosis
    [ ] Other: _____
    _____
    _____

26. What types of test questions do you ask on your written exams?
    [ ] Multiple choice
    [ ] True and False
    [ ] Matching
    [ ] Sentence fill-in, sentence completion
    [ ] Essay

27. Indicate the order in which you cover your cytology subject matter? (Please arrange in numerical order: 1 indicating 1st, 2 indicating 2nd etc.)
    [ ] GYN normal
    [ ] GYN abnormal
    [ ] Respiratory
    [ ] Urinary
    [ ] Fluids
    [ ] Needle aspiration
    [ ] Other: _____

28. Indicate the agency(ies) accreditating your program?
    _____
    _____
    _____
    _____

29. What percent of your students are placed in cytotechnology jobs by graduation?
    [ ] 90 - 100%
    [ ] 70 - 89%
    [ ] 50 - 69%
    [ ] 30 - 49%
    [ ] 10 - 29%
    [ ] Less than 10 %

30. What percentage of your graduates are still practicing cytotechnologists?
    [ ] 0 - 25%
    [ ] 26 - 50%
    [ ] 51 - 75%
    [ ] 76 - 100%
    [ ] Don't know

31. Estimate the number of students you could place in cytotechnologist jobs if your program were larger?
    [ ]

32. Indicate the city or state farthest from your program from which you have received requests by employers seeking cytotechs?
    City/State _____
    Approximate distance in miles _____

COMMENTS:

THANK YOU FOR YOUR COOPERATION!